

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Ingrid SCHEMMEL et al.	<b>Confirmation No. 7650</b>
Appln No.:	10/830,003	Group Art Unit: 1793
Filed:	April 23, 2004	Examiner: Weiping ZHU
For:	COLD WORK STEEL ARTICLE	

**APPEAL BRIEF UNDER 37 C.F.R. § 41.37**

Commissioner for Patents  
U.S. Patent and Trademark Office  
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Randolph Building  
401 Dulany Street  
Alexandria, VA 22314

Sir:

This Appeal is from the Examiner's Final Rejection of claims 1-17 and 28-39 from the Final Office Action mailed from the U.S. Patent and Trademark Office August 8, 2007.

A Notice of Appeal in response to the August 8, 2007 Final Office Action was filed on December 10, 2007. The requisite fee under 37 C.F.R. § 41.20(b)(2) for filing this Appeal Brief is being paid by check in the amount of \$ 510.00, enclosed herewith.

Inasmuch as this Appeal Brief is being filed within the two-month period prescribed by 37 C.F.R. § 41.37 (a)(1), set to expire February 11, 2007 (February 10, 2007 being a Sunday), it is believed that no extension of time is required. However, the Patent and Trademark Office is authorized to charge any fee necessary for maintaining the pendency of this application, including any appeal or extension fees that may be necessary, to Deposit Account No. 19-0089.

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**I. REAL PARTY IN INTEREST**

The real party in interest in this appeal is Boehler Edelstahl GmbH. The corresponding assignment was recorded in the U.S. Patent and Trademark Office on May 25, 2004 at REEL 015366, FRAME 0414.

## **II. RELATED APPEALS AND INTERFERENCES**

Appellants, Appellants' representative, and the Assignee are not aware of any prior and pending appeals, interferences, or judicial proceedings, which may be related to, directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

### **III. STATUS OF CLAIMS**

The status of the claims is as follows:

Claims 1-39 are pending in this application.

Claims 18-27 are withdrawn from consideration as directed to a non-elected invention, pursuant to the restriction requirement made by the Examiner in the Office Action mailed February 28, 2007, and Appellants' election made in the communication dated May 29, 2007.

Each of claims 1-17 and 28-39 is indicated as rejected in the Final Office Action mailed August 8, 2007. Appellants appeal the rejection of claims 1-17 and 28-39.

#### **IV. STATUS OF AMENDMENTS**

There are no amendments that have not been entered. The claims are in their form as amended in the Amendment under 37 C.F.R. § 1.111, filed May 29, 2007.

Appellants note that on January 8, 2008, Appellants' representative, Sean Myers-Payne, contacted Examiner Zhu to discuss entry of a verified partial translation of JP 2003-055747 into the record. Examiner Zhu requested that Appellants provide to him a copy of the verified translation so that he could consider it prior to agreeing to enter it into the record, which Applicants did on January 9, 2008. In a telephone call on January 10, 2008, Examiner Zhu agreed to enter the translation into the record.

Appellants thank the Examiner for his willingness to consider the translation at this stage of prosecution. A copy of the verified partial translation is attached in the Evidence appendix hereto.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

The following description is made with respect to the independent claims and includes reference to particular parts of the specification. As such, the following is merely exemplary and is not a surrender of other aspects of the present invention that are also enabled by the present specification and that are directed to equivalent structures or methods within the scope of the claims.

Independent claim 1 relates to a cold work steel article, wherein the article comprises a material having a composition, in % by weight, of:

Carbon	from more than about 0.6 to less than about 1.0
Silicon	from more than about 0.3 to less than about 0.85
Manganese	from more than about 0.2 to less than about 1.5
Phosphorus	from 0 to about 0.03
Sulfur	from 0 to less than about 0.5
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 1.9 to less than about 3.8
Nickel	from 0 to less than about 0.9
Vanadium	from more than about 1.0 to less than about 2.9
Tungsten	from more than about 1.8 to less than about 3.4
Copper	from 0 to less than about 0.7
Cobalt	from more than about 3.8 to less than about 5.8
Aluminum	from 0 to less than about 0.065
Nitrogen	from 0 to less than about 0.2
Oxygen	from 0 to about 0.012



the balance being iron and accompanying and impurity elements due to smelting, the material produced by a powder metallurgical process. See, e.g., specification page 2, lines 18-28 (paragraph [0009]).

Independent claim 28 relates to a metal material for producing a cold work steel article by a powder metallurgical process, which material comprises, in % by weight:

Carbon	from more than about 0.6 to less than about 1.0
Silicon	from more than about 0.3 to less than about 0.85
Manganese	from more than about 0.2 to less than about 1.5
Phosphorus	from 0 to about 0.03
Sulfur	from 0 to less than about 0.5
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 1.9 to less than about 3.8
Nickel	from 0 to less than about 0.9
Vanadium	from more than about 1.0 to less than about 2.9
Tungsten	from more than about 1.8 to less than about 3.4
Copper	from 0 to less than about 0.7
Cobalt	from more than about 3.8 to less than about 5.8
Aluminum	from 0 to less than about 0.065
Nitrogen	from 0 to less than about 0.2
Oxygen	from 0 to about 0.012

the balance being iron and accompanying and impurity elements due to smelting. See, e.g., specification page 4, lines 8-10, and page 4, lines 24-26 (paragraph [0019]).

**VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

Whether claims 1-17 and 28-39 are unpatentable under 35 U.S.C. § 103(a) over JP 2003-055747, hereinafter “JP ’747.”

## VII. ARGUMENTS

### A. Claims 1 and 28

Whether claims 1 and 28 are unpatentable under 35 U.S.C. § 103(a) over JP 2003-055747, hereinafter “JP ’747.”

#### 1. JP ’747 Does Not Teach Overlapping Ranges

The rejection asserts that JP’747 teaches “a sintered tool steel having a composition in wt% of: 0.8 to 2.5% C, 3 to 8% Cr, 1 to 10% Mo, 1 to 20% W, 1 to 7% V, ≤15% Co, ≤1% Si, ≤1% Mn and the balance Fe with inevitable impurities (abstract)”, and asserts that the composition ranges of the sintered tool steel of JP’747 overlap with the ranges of the presently claimed composition, thereby concluding that a *prima facie* case of obviousness exists.

Appellants respectfully disagree with the Examiner and submit that JP ’747 fails to establish a *prima facie* case of obviousness.

The ultimate determination of patentability is based on the entire record, by a preponderance of evidence, with due consideration to the persuasiveness of any arguments and any secondary evidence. *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997).

However, the Patent Office must consider a reference for all that it teaches. *See*, for example, *EWP Corp. v. Reliance Universal*, 755 F.2d 898, 225 USPQ 20 (Fed. Cir. 1985). It is “impermissible” for the Patent Office to pick and choose from a reference teaching only so much of it as will support its rejection, “to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.” *In re Wesslau*, 353 F.2d 238, 241, 147 U.S.P.Q. 391, 393

(CCPA 1965); *see also Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 448-449, 230 U.S.P.Q. 416, 420 (Fed. Cir. 1986) (holding that the district court, in failing to consider a prior art reference in its entirety, ignored portions of the reference that led away from obviousness). Additionally, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

Appellants respectfully submit that, contrary to the Office Action's assertions, JP '747 does not teach ranges that overlap the presently claimed invention, and thus, without more, a *prima facie* case of obviousness does not exist. Moreover, even if the Board concludes that the ranges do overlap (which Appellants maintain do not), the teachings of JP '747, when considered as a whole, teach away from the present invention.

Appellants respectfully note for the Board that this is an instance in which the rejection turns largely on what the cited reference can be said to fairly convey to a person of ordinary skill in the art. The Examiner's position is that JP '747 teaches ranges of concentrations that overlap Appellants' claimed ranges, thereby establishing a *prima facie* case of obviousness. Appellants maintain that JP '747 includes disclosure that limits the disclosed ranges, such that an overlap does not exist, and at the very least, teaches away from the claimed invention. The Examiner's position is that the limiting disclosure of JP '747 is simply an alternative embodiment, or at the very least, that Appellants' claimed ranges are optimum values for a result-effective variable.

Appellants note that JP '747 as used in the rejection is a machine translation of the original Japanese Patent Laid-open Publication No. 2003-55747. Because the disclosure of JP '747 is critical to the rejection, Appellants have had a verified translation of relevant portions of JP '747 prepared ("the verified partial translation"). Appellants note that a copy of the verified partial translation was provided to Examiner Zhu on January 9, 2008, and Examiner Zhu indicated it would be entered into the record. A copy of the translation is attached hereto in the Evidence Appendix.

Turning to the rejection, the Examiner asserts that JP '747

discloses a sintered tool steel having a composition in wt% of: 0.8 to 2.5% C, 3 to 8 % Cr, 1 to 10% Mo, 1 to 20% W, 1 to 7% V,  $\leq 15\%$  Co,  $\leq 1\%$  Si and  $\leq 1\%$  Mn and the balance Fe with inevitable impurities (abstract). The composition ranges of the elements present in the sintered tool steel of JP ('747) overlap the claimed ranges of the elements respectively. The overlapping establishes a prima facie case of obviousness." (Office Action mailed February 28, 2007, page 3, lines 18-23, citations omitted.)

Appellants respectfully pointed out to the Examiner, in the Amendment under 37 C.F.R. § 1.111 filed May 27, 2007, that the ranges do not overlap, because JP '747 further limits the above-noted ranges of element to a specific ratio of molybdenum (Mo) to tungsten (W) of:  $2\text{Mo} + \text{W} = 15\text{-}30\%$ . Appellants noted that the presently claimed ranges do not overlap this element: Appellants' recited upper value for  $2\text{Mo} + \text{W}$  is 11%. (See Amendment under 37 C.F.R. § 1.111 filed May 27, 2007, page 21, last full paragraph.)

In response to Appellants' arguments, the Examiner stated that the rejection was based upon "the prior art's broad disclosure rather than preferred embodiments." (Office Action mailed August 8, 2007, page 3, lines 24-25.) In the Advisory Action mailed November 26, 2007, the Examiner asserted that "it is well held that mere disclosure of alternative designs does not teach away," citing *In re Fulton* 391 F.3d 1195, 1201, 73 U.S.P.Q.2d 1141, 1146 (Fed. Cir. 2004). (Advisory Action mailed August 8, 2007, page 2, lines 6-7.)

Appellants respectfully submit to the Board that JP '747 does not teach ranges that overlap Appellants' claimed ranges. Appellants respectfully note that JP '747 teaches "a composition containing, by weight, 0.8 to 2.5% C, 3 to 8 % Cr, 1 to 10% Mo, 1 to 20% W, 1 to 7% V,  $\leq 15\%$  Co,  $\leq 1\%$  Si and  $\leq 1\%$  Mn, and *in which the W equivalent ( $2\text{Mo} + \text{W}$ ) simultaneously satisfies 15 to 30%, and the balance Fe with inevitable impurities."* (JP '747, Abstract, emphasis added.) Appellants note that the requirement that  $(2\text{Mo} + \text{W}) = 15\text{-}30\%$  is reflected throughout the JP '747 disclosure, including in the abstract, all six supporting examples, and in numerous places throughout the specification (see JP '747 and the verified partial translation, paragraphs [006], [009], [0013], and

[0028]). In no instance is the requirement set forth as a preference, an alternative, an embodiment, or in any way optional. Rather, it is part and parcel with the remainder of the disclosed ranges.

In paragraph [0009], JP '747 explains why the ratio of Mo to W is critical:

Both Mo and W are comprised of carbide and provide abrasion resistance. During quench hardening, they increase strength and hardness by partially providing a solid solution on the base, while being effective elements that improve heat resistance. It is necessary that greater than or equal to 1% of both the Mo and W is contained and that W equivalent ( $2\text{Mo} + \text{W}$ ) is simultaneously greater than or equal to 15%. When Mo and W are greater than 10% and 20% respectively, and W equivalent ( $2\text{Mo} + \text{W}$ ) is greater than 30%, the amount of carbide becomes large, thereby significantly decreasing the toughness. Therefore, the upper limit was set as the above.

(The verified partial translation, paragraph [0009].) Thus, “[i]t is *necessary* that . . . ( $2\text{Mo} + \text{W}$ ) is simultaneously greater than or equal to 15%.” There is nothing in the disclosure of JP '747 that allows the other disclosed concentration ranges of Mo and W of 1-20% and 1-7%, respectively, to be considered without also considering that ( $2\text{Mo} + \text{W}$ ) must “simultaneously” be 15-30%.

Appellants' independent claims 1 and 28 recite that Mo be “from more than about 1.9 to less than about 3.8” and W be “from more than about 1.8 to less than about 3.4”. Applying Appellants' claimed ranges to JP '747's requirement of ( $2\text{Mo} + \text{W}$ ), one arrives at a maximum value of 11% ( $(2 \times 3.8) + 3.4$ ), which does not overlap the 15-30% requirement of JP '747. Thus, Appellants respectfully submit that JP '747's ranges do not overlap Appellants' claimed ranges, and thus, without more, a *prima facie* case of obviousness does not exist.

Appellants also respectfully note that this is not an instance in which the cited art discloses alternatives and the cited art's preference for one is argued to constitute a rejection of, or teaching away from, another. (See *In re Fulton* 391 F.3d 1195, 1201, 73 U.S.P.Q.2d 1141, 1146 (Fed. Cir. 2004). As noted above, the disclosure that ( $2\text{Mo} + \text{W}$ ) = 15-30% is a requirement, similar to the requirement that Mo be 1-20% and that W be 1-7%. The concentration ranges for Mo and W do not exist independently of the

requirement that their relationship be governed by the equation that  $2\text{Mo} + \text{W} = 15\text{-}30\%$ . Thus, the additional requirement of  $2\text{Mo} + \text{W} = 15\text{-}30\%$  is not an "alternative."

**2. A Person of Ordinary Skill in the Art Would Not Modify JP '747 to Arrive at the Claimed Invention**

In the Final Office Action (mailed August 8, 2007), the Examiner takes the position that the requirement of  $(2\text{Mo} + \text{W}) = 15\text{-}30\%$  is a preferred embodiment in JP '747, and that it would have been obvious to one of ordinary skill in the art to have selected Appellants' claimed ranges within the disclosed ranges of JP '747, because JP '747 "discloses the same utility over the whole disclosed ranges." (Office Action mailed August 8, 2007, page 4, lines 5-6.) In the Advisory Action mailed November 26, 2007, the Examiner asserts that "the purpose of the limitation of the total weight percentage of W and Mo in JP '747 is to ensure desired amount of carbide in the steel. It would have been obvious to one of ordinary skill in the art that the lower  $(2\text{Mo} + \text{W})$  percentage of the instant invention would lead to a lower amount of carbide in the steel. It is well held that mere disclosure of alternative designs does not teach away." (Advisory Action mailed November 26, 2007, page 2, lines 9-12, citations omitted.)

Initially, as noted above, Appellants respectfully submit that  $(2\text{Mo} + \text{W}) = 15\text{-}30\%$  is not a "preferred embodiment" or an "alternative" in JP '747. Rather, as discussed above, it is a requirement. When this fact is considered, it is clear that the cited art fails to create a *prima facie* case of obviousness based on overlapping ranges alone. However, beyond this particular issue, Appellants submit that the teachings of JP '747 would not lead a person of skill in the art to Appellants' claimed invention.

The purpose of the particularly recited ranges of Mo and W in claims 1 and 28 is discussed in the present specification at page 5, lines 26 - 31:

In particular, a deterioration of the toughness of the matrix may be caused already by concentrations of as little as about 3.8% by weight of molybdenum (Mo) and about 3.4% by weight of tungsten (W). However, concentrations of greater than about 1.9% by weight of molybdenum (Mo) and about 1.8% by weight of tungsten (W) are desirable for an advantageous masking of vanadium, to thereby avoid the formation of large sharp-edged monocarbides.

In this passage, the specification explains why the upper values for Mo and W content are important to achieving the desired end product.

Appellants respectfully note that the presently claimed alloy has very different properties than the alloy described in JP '747. While the present invention focuses on, among other parameters, a low carbide content in order to improve toughness, JP '747 centers on the formation of a microfine structure, while at the same time maintaining a high carbide content. Alloy compositions as disclosed in JP '747, which are characterized by having high carbide content, are discussed in the background section of the present specification. Paragraph [0006] of the present specification states that such steels "exhibit increased resistance to abrasive wear," usually have a high carbon content of up to 2.5 % by weight and a "concentration of monocarbide-forming elements of up to 15 % by weight, i.e., a high carbide content." The present specification further notes that such steels, however, exhibit a low toughness in a heat-treated state, and that "the microstructure, in particular the carbide size and the carbide distribution in the material of the article can be improved by a powder metallurgical production, but in many cases the required toughness of the material can still not be achieved." Thus, while JP '747 taught that a high carbide content (ensured by the formula of  $(2\text{Mo} + \text{W}) = 15\text{-}30\%$ ) was desirable to achieving toughness, the present inventors discovered that a lower carbide content was actually more desirable.

Appellants respectfully submit that a person of ordinary skill in the art would not select a lower carbide content based on the teaching of JP '747. JP '747 does not teach that the strength of the alloys can be improved by lowering the amount of carbide forming elements. The focus in JP '747 lies on the achievement of a microfine grain structure and JP '747 discusses such structure as the main reason for the improved material properties. (See, e.g., JP '747 paragraph [0028].) Nothing in JP '747 would lead away from the specific directions and concentration provided therein.

Appellants have chosen a course that is away from the teachings of JP '747. Where JP '747 teaches the inclusion of carbide-forming elements that higher, Appellants have claimed concentrations that are lower. As the Federal Circuit has repeatedly



recognized, proceeding contrary to the accepted wisdom in the art represents "strong evidence of unobviousness." *In re Hedges*, 783 F.2d at 1041, 228 U.S.P.Q. at 687; *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d at 1552, 220 U.S.P.Q. at 312 (prior art teaching that conventional polypropylene should have reduced crystallinity before stretching and should undergo slow stretching, led away from claimed process of producing porous article by expanding highly crystalline PTFE by rapid stretching).

Additionally, given the very strong emphasis on the importance of (2Mo + W) being 15-30% (see reference to "necessary" in paragraph [0009] of the verified partial translation), it is reasonable to conclude that a choice of any other values would destroy the intended function of, or perhaps even render inoperable, the alloy disclosed in '747. And the courts have clearly stated that if a proposal for modifying the prior art in an effort to attain the claimed invention causes the art to become inoperable or destroys its intended function, then a person of skill in the art would not have made such change. See, for example, *In re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992); *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In view of the foregoing, Appellants respectfully submit that the cited art does not disclose overlapping ranges and that there is nothing in the cited art that would lead a person of ordinary skill in the art to the invention presently claimed in claims 1 or 28.

## **B. Claim 2**

The rejection of claim 2 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 2 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 2 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**C. Claim 3**

The rejection of claim 3 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 3 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 3 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Additionally, Appellants respectfully note that claim 3 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 1, 11% is the upper value (as discussed above). In claim 3,  $2Mo + W = 9.8\%$  is the upper value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 3 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**D. Claim 4**

The rejection of claim 4 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 4 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 4 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Additionally, Appellants respectfully note that claim 4 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 1, 11% is the upper value (as discussed above). In claim 4,  $2Mo + W = 9.8\%$  is the upper value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 4 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **E. Claim 5**

The rejection of claim 5 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 5 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 5 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Additionally, Appellants respectfully note that claim 5 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 1, 11% is the upper value (as discussed above). In claim 5,  $2Mo + W = 9.0\%$  is the upper value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 5 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **F. Claim 6**

The rejection of claim 6 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 6 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 6 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Additionally, Appellants respectfully note that claim 6 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 1, 11% is the upper value (as discussed above). In claim 6,  $2Mo + W = 9.0\%$  is the upper

value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 6 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **G. Claim 7**

The rejection of claim 7 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 7 is dependent upon and includes the subject matter recited in claims 4 and 1. Therefore, the obviousness rejection based upon claim 7 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 4 and 1.

Additionally, Appellants respectfully note that claim 7 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 1, 11% is the upper value (as discussed above). In claim 7,  $2Mo + W = 9.0\%$  upper value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 7 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **H. Claim 8**

The rejection of claim 8 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 8 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 8 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**I. Claim 9**

The rejection of claim 9 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 9 is dependent upon and includes the subject matter recited in claims 3 and 1. Therefore, the obviousness rejection based upon claim 9 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 3 and 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**J. Claim 10**

The rejection of claim 10 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 10 is dependent upon and includes the subject matter recited in claims 6 and 1. Therefore, the obviousness rejection based upon claim 10 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 6 and 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**K. Claim 11**

The rejection of claim 11 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 11 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 11 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**L. Claim 12**

The rejection of claim 12 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 12 is dependent upon and includes the subject matter recited in claims 3 and 1. Therefore, the obviousness rejection based upon claim 12 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 3 and 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**M. Claim 13**

The rejection of claim 13 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 13 is dependent upon and includes the subject matter recited in claims 5 and 1. Therefore, the obviousness rejection based upon claim 13 is

without appropriate basis for at least the reasons set forth by Appellants with respect to claims 5 and 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **N. Claim 14**

The rejection of claim 14 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 14 is dependent upon and includes the subject matter recited in claims 9, 3, and 1. Therefore, the obviousness rejection based upon claim 14 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 9, 3, and 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **O. Claim 15**

The rejection of claim 15 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 15 is dependent upon and includes the subject matter recited in claim 1. Therefore, the obviousness rejection based upon claim 15 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**P. Claim 16**

The rejection of claim 16 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 16 is dependent upon and includes the subject matter recited in claims 15 and 1. Therefore, the obviousness rejection based upon claim 16 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 15 and 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**Q. Claim 17**

The rejection of claim 17 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 17 is dependent upon and includes the subject matter recited in claims 16, 15, and 1. Therefore, the obviousness rejection based upon claim 17 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 16, 15, and 1.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**R. Claim 29**

The rejection of claim 29 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.



Appellants note that claim 29 is dependent upon and includes the subject matter recited in claim 28. Therefore, the obviousness rejection based upon claim 29 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **S. Claim 30**

The rejection of claim 30 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 30 is dependent upon and includes the subject matter recited in claim 28. Therefore, the obviousness rejection based upon claim 30 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 28.

Additionally, Appellants respectfully note that claim 30 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 28, 11% is the upper value (as discussed above). In claim 3,  $2Mo + W = 9.8\%$  is the upper value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 30 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **T. Claim 31**

The rejection of claim 31 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 31 is dependent upon and includes the subject matter recited in claims 30 and 28. Therefore, the obviousness rejection based upon claim 31 is

without appropriate basis for at least the reasons set forth by Appellants with respect to claims 30 and 28.

Additionally, Appellants respectfully note that claim 31 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 28, 11% is the upper value (as discussed above). In claim 31,  $2Mo + W = 9.0\%$  is the upper value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 31 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **U. Claim 32**

The rejection of claim 32 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 32 is dependent upon and includes the subject matter recited in claim 28. Therefore, the obviousness rejection based upon claim 32 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 28.

Additionally, Appellants respectfully note that claim 32 is even farther away from the cited art. Whereas if the equation  $2Mo + W$  is applied to the elements of claim 28, 11% is the upper value (as discussed above). In claim 32,  $2Mo + W = 9.0\%$  is the upper value. Again, the cited art requires that  $2Mo + W = 15-30\%$ . Thus, the subject matter of claim 32 is even more nonobvious.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**V. Claim 33**

The rejection of claim 33 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 33 is dependent upon and includes the subject matter recited in claim 28. Therefore, the obviousness rejection based upon claim 33 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**W. Claim 34**

The rejection of claim 34 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 34 is dependent upon and includes the subject matter recited in claims 33 and 28. Therefore, the obviousness rejection based upon claim 34 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 33 and 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**X. Claim 35**

The rejection of claim 35 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 35 is dependent upon and includes the subject matter recited in claims 31 and 28. Therefore, the obviousness rejection based upon claim 35 is

without appropriate basis for at least the reasons set forth by Appellants with respect to claims 31 and 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **Y. Claim 36**

The rejection of claim 36 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 36 is dependent upon and includes the subject matter recited in claim 28. Therefore, the obviousness rejection based upon claim 36 is without appropriate basis for at least the reasons set forth by Appellants with respect to claim 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

#### **Z. Claim 37**

The rejection of claim 37 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 37 is dependent upon and includes the subject matter recited in claims 36 and 28. Therefore, the obviousness rejection based upon claim 37 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 36 and 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**AA. Claim 38**

The rejection of claim 38 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

Appellants note that claim 38 is dependent upon and includes the subject matter recited in claims 37, 36, and 28. Therefore, the obviousness rejection based upon claim 38 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 37, 36, and 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**BB. Claim 39**

The rejection of claim 39 under 35 U.S.C. § 103(a) as allegedly being obvious over JP'747 is in error, the decision of the Examiner to finally reject this claim should be reversed, and the application should be remanded to the Examiner.

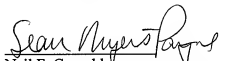
Appellants note that claim 39 is dependent upon and includes the subject matter recited in claims 38, 37, 36, and 28. Therefore, the obviousness rejection based upon claim 39 is without appropriate basis for at least the reasons set forth by Appellants with respect to claims 38, 37, 36, and 28.

Appellants respectfully submit that the obviousness rejection over JP '747 should be withdrawn.

**VIII. CONCLUSION**

Appellants respectfully submit that, for at least of the foregoing reasons, the Examiner has failed to establish a *prima facie* case of obviousness of the subject matter of any of claims 1-17, and 28-39, which is a prerequisite for maintaining a rejection under 35 U.S.C. § 103. The Board is, therefore, respectfully requested to reverse the Examiner's decision to reject claims 1-17 and 28-39, and to allow the application to issue in its present form.

Respectfully submitted,  
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**IX. CLAIMS APPENDIX**

1. A cold work steel article, wherein the article comprises a material having a composition, in % by weight, of:

Carbon	from more than about 0.6 to less than about 1.0
Silicon	from more than about 0.3 to less than about 0.85
Manganese	from more than about 0.2 to less than about 1.5
Phosphorus	from 0 to about 0.03
Sulfur	from 0 to less than about 0.5
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 1.9 to less than about 3.8
Nickel	from 0 to less than about 0.9
Vanadium	from more than about 1.0 to less than about 2.9
Tungsten	from more than about 1.8 to less than about 3.4
Copper	from 0 to less than about 0.7
Cobalt	from more than about 3.8 to less than about 5.8
Aluminum	from 0 to less than about 0.065
Nitrogen	from 0 to less than about 0.2
Oxygen	from 0 to about 0.012

the balance being iron and accompanying and impurity elements due to smelting, the material produced by a powder metallurgical process.

2. The article of claim 1, wherein the article, when subjected to a heat treatment to a hardness of about 64 HRC, has an impact strength at room temperature of higher than about 40 J.

3. The article of claim 1, wherein one or more elements in the material are present in the following concentrations:

Carbon	from more than about 0.75 to less than about 0.94
Silicon	from more than about 0.35 to less than about 0.7
Manganese	from more than about 0.25 to less than about 0.9

Phosphorus	from 0 to about 0.025
Sulfur	from 0 to less than about 0.34
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 2.2 to less than about 3.4
Nickel	from 0 to less than about 0.5
Vanadium	from more than about 1.5 to less than about 2.6
Tungsten	from more than about 2.0 to less than about 3.0
Copper	from 0 to less than about 0.45
Cobalt	from more than about 4.0 to less than about 5.0
Aluminum	from 0 to less than about 0.05
Nitrogen	from more than about 0.01 to less than about 0.1
Oxygen	from 0 to about 0.010.

4. The article of claim 1, wherein the elements in the material are present in the following concentrations:

Carbon	from more than about 0.75 to less than about 0.94
Silicon	from more than about 0.35 to less than about 0.7
Manganese	from more than about 0.25 to less than about 0.9
Phosphorus	from 0 to about 0.025
Sulfur	from 0 to less than about 0.34
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 2.2 to less than about 3.4
Nickel	from 0 to less than about 0.5
Vanadium	from more than about 1.5 to less than about 2.6
Tungsten	from more than about 2.0 to less than about 3.0
Copper	from 0 to less than about 0.45
Cobalt	from more than about 4.0 to less than about 5.0
Aluminum	from 0 to less than about 0.05
Nitrogen	from more than about 0.01 to less than about 0.1
Oxygen	from 0 to about 0.010.



5. The article of claim 1, wherein one or more elements in the material are present in the following concentrations:

Carbon	from more than about 0.8 to less than about 0.9
Silicon	from more than about 0.4 to less than about 0.65
Manganese	from more than about 0.3 to less than about 0.5
Phosphorus	from 0 to about 0.025
Sulfur	from 0 to about 0.025
Chromium	from more than about 4.1 to less than about 4.5
Molybdenum	from more than about 2.5 to less than about 3.0
Nickel	from 0 to less than about 0.5
Vanadium	from more than about 1.8 to less than about 2.4
Tungsten	from more than about 2.0 to less than about 3.0
Copper	from 0 to about 0.3
Cobalt	from more than about 4.2 to less than about 4.8
Aluminum	from more than about 0.01 to less than about 0.045
Nitrogen	from more than about 0.05 to less than about 0.08
Oxygen	from 0 to about 0.009.

6. The article of claim 1, wherein the elements in the material are present in the following concentrations:

Carbon	from more than about 0.8 to less than about 0.9
Silicon	from more than about 0.4 to less than about 0.65
Manganese	from more than about 0.3 to less than about 0.5
Phosphorus	from 0 to about 0.025
Sulfur	from 0 to about 0.025
Chromium	from more than about 4.1 to less than about 4.5
Molybdenum	from more than about 2.5 to less than about 3.0
Nickel	from 0 to less than about 0.5
Vanadium	from more than about 1.8 to less than about 2.4
Tungsten	from more than about 2.0 to less than about 3.0
Copper	from 0 to about 0.3

Cobalt	from more than about 4.2 to less than about 4.8
Aluminum	from more than about 0.01 to less than about 0.045
Nitrogen	from more than about 0.05 to less than about 0.08
Oxygen	from 0 to about 0.009.

7. The article of claim 4, wherein one or more elements in the material are present in the following concentrations:

Carbon	from more than about 0.8 to less than about 0.9
Silicon	from more than about 0.4 to less than about 0.65
Manganese	from more than about 0.3 to less than about 0.5
Sulfur	from 0 to about 0.025
Chromium	from more than about 4.1 to less than about 4.5
Molybdenum	from more than about 2.5 to less than about 3.0
Vanadium	from more than about 1.8 to less than about 2.4
Copper	from 0 to about 0.3
Cobalt	from more than about 4.2 to less than about 4.8
Aluminum	from more than about 0.01 to less than about 0.045
Nitrogen	from more than about 0.05 to less than about 0.08
Oxygen	from 0 to about 0.009.

8. The article of claim 1, wherein one or more impurity elements in the material are present in the following concentrations in % by weight:

Tin	0 to not more than about 0.02
Antimony	0 to not more than about 0.022
Arsenic	0 to not more than about 0.03
Selenium	0 to not more than about 0.012
Bismuth	0 to not more than about 0.01.

9. The article of claim 3, wherein one or more impurity elements in the material are present in the following concentrations in % by weight:

Tin	0 to not more than about 0.02
-----	-------------------------------

Antimony	0 to not more than about 0.022
Arsenic	0 to not more than about 0.03
Selenium	0 to not more than about 0.012
Bismuth	0 to not more than about 0.01.

10. The article of claim 6, wherein impurity elements in the material are present in the following concentrations in % by weight:

Tin	0 to not more than about 0.02
Antimony	0 to not more than about 0.022
Arsenic	0 to not more than about 0.03
Selenium	0 to not more than about 0.012
Bismuth	0 to not more than about 0.01.

11. The article of claim 1, wherein the article has a pressure yielding point at a hardness of about 61 HRC of higher than about 2,700 MPa.

12. The article of claim 3, wherein the article, when subjected to a heat treatment to a hardness of about 64 HRC, has an impact strength at room temperature of higher than about 80 J.

13. The article of claim 5, wherein the article, when subjected to a heat treatment to a hardness of about 64 HRC, has an impact strength at room temperature of higher than about 100 J.

14. The article of claim 9, wherein the article, when subjected to a heat treatment to a hardness of about 64 HRC, has an impact strength at room temperature of higher than about 100 J.

15. The article of claim 1, wherein the powder metallurgical process comprises atomizing the melt with nitrogen to produce a metal powder having a powder grain size of not larger than about 500  $\mu\text{m}$ .

16. The article of claim 15, wherein the powder metallurgical process further comprises placing the metal powder into a vessel while avoiding oxygen admission, closing the vessel and hot isostatically pressing the metal powder in the closed vessel to produce a blank.

17. The article of claim 16, wherein the process further comprises a hot forming of the blank.

28. A metal material for producing a cold work steel article by a powder metallurgical process, which material comprises, in % by weight:

Carbon	from more than about 0.6 to less than about 1.0
Silicon	from more than about 0.3 to less than about 0.85
Manganese	from more than about 0.2 to less than about 1.5
Phosphorus	from 0 to about 0.03
Sulfur	from 0 to less than about 0.5
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 1.9 to less than about 3.8
Nickel	from 0 to less than about 0.9
Vanadium	from more than about 1.0 to less than about 2.9
Tungsten	from more than about 1.8 to less than about 3.4
Copper	from 0 to less than about 0.7
Cobalt	from more than about 3.8 to less than about 5.8
Aluminum	from 0 to less than about 0.065
Nitrogen	from 0 to less than about 0.2
Oxygen	from 0 to about 0.012

the balance being iron and accompanying and impurity elements due to smelting.

29. The material of claim 28, wherein one or more elements in the material are present in the following concentrations:

Carbon	from more than about 0.75 to less than about 0.94
Silicon	from more than about 0.35 to less than about 0.7

Manganese	from more than about 0.25 to less than about 0.9
Phosphorus	from 0 to about 0.025
Sulfur	from 0 to less than about 0.34
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 2.2 to less than about 3.4
Nickel	from 0 to less than about 0.5
Vanadium	from more than about 1.5 to less than about 2.6
Tungsten	from more than about 2.0 to less than about 3.0
Copper	from 0 to less than about 0.45
Cobalt	from more than about 4.0 to less than about 5.0
Aluminum	from 0 to less than about 0.05
Nitrogen	from more than about 0.01 to less than about 0.1
Oxygen	from 0 to about 0.010.

30. The material of claim 28, wherein the elements in the material are present in the following concentrations:

Carbon	from more than about 0.75 to less than about 0.94
Silicon	from more than about 0.35 to less than about 0.7
Manganese	from more than about 0.25 to less than about 0.9
Phosphorus	from 0 to about 0.025
Sulfur	from 0 to less than about 0.34
Chromium	from more than about 4.0 to less than about 6.2
Molybdenum	from more than about 2.2 to less than about 3.4
Nickel	from 0 to less than about 0.5
Vanadium	from more than about 1.5 to less than about 2.6
Tungsten	from more than about 2.0 to less than about 3.0
Copper	from 0 to less than about 0.45
Cobalt	from more than about 4.0 to less than about 5.0
Aluminum	from 0 to less than about 0.05
Nitrogen	from more than about 0.01 to less than about 0.1
Oxygen	from 0 to about 0.010.

31. The material of claim 30, wherein one or more elements in the material are present in the following concentrations:

Carbon	from more than about 0.8 to less than about 0.9
Silicon	from more than about 0.4 to less than about 0.65
Manganese	from more than about 0.3 to less than about 0.5
Sulfur	from 0 to about 0.025
Chromium	from more than about 4.1 to less than about 4.5
Molybdenum	from more than about 2.5 to less than about 3.0
Vanadium	from more than about 1.8 to less than about 2.4
Copper	from 0 to about 0.3
Cobalt	from more than about 4.2 to less than about 4.8
Aluminum	from more than about 0.01 to less than about 0.045
Nitrogen	from more than about 0.05 to less than about 0.08
Oxygen	from 0 to about 0.009.

32. The material of claim 28, wherein the elements in the material are present in the following concentrations:

Carbon	from more than about 0.8 to less than about 0.9
Silicon	from more than about 0.4 to less than about 0.65
Manganese	from more than about 0.3 to less than about 0.5
Phosphorus	from 0 to about 0.025
Sulfur	from 0 to about 0.025
Chromium	from more than about 4.1 to less than about 4.5
Molybdenum	from more than about 2.5 to less than about 3.0
Nickel	from 0 to less than about 0.5
Vanadium	from more than about 1.8 to less than about 2.4
Tungsten	from more than about 2.0 to less than about 3.0
Copper	from 0 to about 0.3
Cobalt	from more than about 4.2 to less than about 4.8
Aluminum	from more than about 0.01 to less than about 0.045

Nitrogen	from more than about 0.05 to less than about 0.08
Oxygen	from 0 to about 0.009.

33. The material of claim 28, wherein one or more impurity elements in the material are present in the following concentrations in % by weight:

Tin	0 to not more than about 0.02
Antimony	0 to not more than about 0.022
Arsenic	0 to not more than about 0.03
Selenium	0 to not more than about 0.012
Bismuth	0 to not more than about 0.01.

34. The material of claim 32, wherein impurity elements in the material are present in the following concentrations in % by weight:

Tin	0 to not more than about 0.02
Antimony	0 to not more than about 0.022
Arsenic	0 to not more than about 0.03
Selenium	0 to not more than about 0.012
Bismuth	0 to not more than about 0.01.

35. The material of claim 31, wherein the material, when subjected to a heat treatment to a hardness of about 64 HRC, has an impact strength at room temperature of higher than about 100 J.

36. A metal powder which comprises the material of claim 28.

37. The metal powder of claim 36, wherein the metal powder has a powder grain size of not larger than about 500  $\mu\text{m}$ .

38. The metal powder of claim 37, wherein the metal powder has been produced by atomization of a metal melt with an inert gas.

39. The metal powder of claim 38, wherein the inert gas comprises nitrogen.



**X. EVIDENCE APPENDIX**

- Verified Partial Translation of Japanese Patent Laid-open Publication No. 2003-55747,  
appended hereto.

**XI. RELATED PROCEEDINGS APPENDIX**

None.

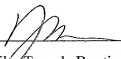
VERIFICATION OF TRANSLATION

I, Yukiko Toyoda Buntin  
of 1950 Roland Clarke Place  
Reston, VA 20191

declare that I am well acquainted with both the Japanese and English languages, and that the attached is an accurate partial translation, to the best of my knowledge and ability, of Japanese Patent Laid-open Publication No. 2003-55747, published February 26, 2003.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the above-captioned application or any patent issued thereon.

Signature

  
Yukiko Toyoda Buntin

Date 1-7-08

## **Partial Translation of Japanese Laid Open Publication 2003-55747**

[0006] The chemical component of the sintered tool steel according to claim 1 of the present invention may be similar to the conventional tool steel, i.e., carbon tool steel, alloy tool steel, high speed tool steel, etc. However, it is more preferable that the sintered tool steel has the alloy component containing, by weight, 0.8 – 2.5% C, 3 – 8% Cr, 1 – 10% Mo, 1 – 20% W, 1 – 7% V,  $\leq 15\%$  Co,  $\leq 1\%$  Si, and  $\leq 1\%$  Mn, while W equivalent ( $2\text{Mo} + \text{W}$ ) is simultaneously 15 – 30%, and the remaining is Fe and inevitable impurities (claim 2).

[0009] Both Mo and W are comprised of carbide and provide abrasion resistance. During quench hardening, they increase strength and hardness by partially providing a solid solution on the base, while being effective elements that improve heat resistance. It is necessary that greater than or equal to 1% of both the Mo and W are contained and that W equivalent ( $2\text{Mo} + \text{W}$ ) is simultaneously greater than or equal to 15%. When Mo and W are greater than 10% and 20% respectively, and W equivalent ( $2\text{Mo} + \text{W}$ ) is greater than 30%, the amount of carbide becomes large, thereby significantly decreasing the toughness. Therefore, the upper limit was set as the above.

[0013] This high-strength, ultra-fine grain sintered tool steel is obtained as follows. In particular, according to claim 4 of the present invention, the alloy that has, by weight, 0.8 – 2.5% C, 3 – 8% Cr, 1 – 10% Mo, 1 – 20% W, 1 – 7% V,  $\leq 15\%$  Co,  $\leq 1\%$  Si, and  $\leq 1\%$  Mn, while W equivalent ( $2\text{Mo} + \text{W}$ ) being simultaneously 15 – 30%, and the remaining being Fe and inevitable impurities, is dissolved by a high-frequency smelting furnace. At the same time, liquid quenching powder is obtained through a gas-atomization or water-atomization process. Thereafter, the quenching powder is classified to be smaller than or equal to  $75\mu\text{m}$  (grain size), reinforced through a ball mill or the like to manufacture high-deformation milling powder. Then, the milling powder is filled into a steel container for a vacuum degassing process at  $400 - 600\text{C}^{\circ}$  and heated at  $800 - 1000\text{C}^{\circ}$ . At the same time, rolling under a rolling reduction rate of 70 – 90% or extrusion under an extrusion ratio of 4 – 10 is performed to form and sinter the sintered tool steel. By providing the above-described manufacturing method, it was possible to obtain sintered tool steel having the carbide maximum grain size in alloy of  $\leq 0.6\mu\text{m}$  and the average grain size of austenitic crystals of  $\leq 2.0\mu\text{m}$ .

[0028] The composition of the alloy component contains, by weight, 0.8 – 2.5% C, 3 – 8% Cr, 1 – 10% Mo, 1 – 20% W, 1 – 7% V,  $\leq 15\%$  Co,  $\leq 1\%$  Si, and  $\leq 1\%$  Mn, while W equivalent

(2Mo + W) is simultaneously 15 – 30%, and the remaining is Fe and inevitable impurities. The carbide was refined while performance as tool steel was ensured. At the same time, by utilizing a pinning effect of the oxide that inhibits the growth of crystal grain, the super fine grain configuration was easily obtained.

[0029] By combining with the conventional methods, such as high-frequency smelting, gas-atomization/water-atomization, ball milling, vacuum degassing, and heated rolling/extrusion, the manufacturing method of the high-strength, ultra-fine grain sintered tool steel is easily provided by the present invention, which proved to be industrially beneficial.